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Zero Latency: Wait-less Computing.(Technology Information)

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The wordsmiths and analysts of the Gartner Group recently coined a phrase that they believe describes the most important computing trend for the next decade: zero latency. Webster's Dictionary defines latent as "present or potential, but not visible or apparent." And "latent" exactly describes the majority of data in the typical enterprise: captured, logged and stored, but invisible to those who could benefit from access to the information. The Zero Latency Enterprise (ZLE) is not about storing data in yet another database, but about immediately moving information to the various players who need it.

Internet shopping has shown us the tip of the ZLE iceberg. You browse to find an item, check stock, fill out an electronic order form and submit the form for processing. In more advanced systems, you receive an immediate e-mail acknowledgment of the order, as well as a confirmation e-mail when your order is shipped. This interactive model works pretty well for the average consumer, but it scales poorly when used for high-volume business processes.

For business, a more productive version of the same scenario should involve more cooperation between IT infrastructures. A company's purchasing system, for example, could allow employees to initiate purchase orders (PO) directly from their browsers. The system can then request quotes on the ordered items from an Internet pool of suppliers. The POs and bids are automatically routed to the designated employee for approval. Once approved, the orders are placed electronically to the chosen suppliers. The status of the pending orders are sent back electronically, not as an unstructured e-mail, but as an intelligent message that can be used to update the local purchasing database. All the while, employees waiting for their purchases are notified about status changes on their particular orders.

Universal order processing is one of the simplest examples of reducing latency inherent in today's business communications. Airlines and event promoters have to keep information latency short, or their reservation systems will fail altogether. In general, the availability of timely information makes intelligent resource planning decisions possible. Rather than relying solely on forecasting with a murky crystal ball, a ZLE can continuously adjust resources on the basis of real-time inputs. Since the information infrastructure of a ZLE is able to respond to dynamic changes in resource requirements, effectively bartering of resources such as manufacturing capacity might become a key ingredient to having a responsive zero latency business. Fortunately, zero latency can also help a business to effectively buy and sell excess resource capacity as the business' needs fluctuate.

Although the buzzword is new, zero latency -- or at least reduced latency -- has been the goal of IT since the beginning. Making census data available while it was still worthwhile was the major impetus for the first computers. The technologies needed for true zero latency systems, however, have only recently become available:

A worldwide network-- To achieve zero latency, our businesses and partners have to be linked. The public Internet provides the proof, if not the vehicle, for globally interconnected businesses. While security and performance issues remain, the question is no longer "Can we all get connected?" but "What method shall we choose to get connected?"

A standard language for messages-- Determining the right way in which to interchange information has historically been a stumbling block for electronic business communication. Enter Extensible Markup Language (XML), which may well be the most quickly adopted technology in computing history. XML provides a simple, robust and human-readable method for describing any content. XML also allows industries to create domain-specific templates. Insurance companies, for example, can standardize the mark-up tags for all claim information.

Message-oriented middleware-- Because of the scope of zero latency enterprises, the likelihood of encountering one or more unavailable systems increases. Traditional two- and three-tier applications falter when the target databases aren't up and running. Message-oriented middleware enables asynchronous communication, ensuring that the information is delivered as soon as offline resources are restored.

The technical pieces are in place for what the Gartner Group believes to be the next digital revolution. While Gartner's prediction that zero latency will be the key technology for the next decade seems to ignore how quickly the technological landscape changes, zero latency is definitely the focus of cutting-edge companies today. Just imagine the slogan we can use for the business Internet of the future: One billion computers, no waiting.
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ABSTRACT: In an Internet-savvy corporate environment where instant results are becoming standard practice, accounting, finance, and purchasing professionals must re-examine ways to keep pace with the needs of modern business. The days of multiple purchase orders, manual purchase requisitions, and random expense purchases must end. A Web-based procurement system can be used to summon a virtual shopping cart enabling you to order items right away. In fact, Web-based procurement systems actually transform employees into strategic buyers by granting them control over a subset of preapproved and budgeted items. Also, cash that previously had been lost in the shuffle of unregulated, inefficient purchasing will re-emerge on the bottom line. And the modern reengineered workplace will enjoy intelligent procurement systems that not only save money but provide significant savings in time and resources.
TEXT: It's one frantic afternoon. A division manager desperately needs her computer repaired. The sales team, late for a plane flight to a trade show in the next state, is clamoring for more presentation supplies and tabbed sales folders. Meanwhile, the human resources director says he needs a new cartridge for his laser printer, lunch for five employees visiting from a branch office, overnight shipping labels, and courier service to a sales office up the interstate. Do you want to be the one to tell them it may take up to a week to process their requests? In an Internet-savvy corporate environment where instant results are becoming standard business practice, you as accounting, finance, and purchasing professionals must re-examine ways to keep pace with the needs of modern business. Your company is depending on you.

The days of multiple purchase orders, manual purchase requisitions, and random expense purchases must end. Instead of wading through an alphabet soup of paper PO.s and PR.s (purchase orders and purchase requisitions) that can take days or weeks to process, employees will go to their computers and use a Web-based procurement system to summon a virtual shopping cart and order items they need right away. In fact, Web-based procurement systems actually transform employees into strategic buyers by granting them control over a subset of preapproved and budgeted items. No longer will they have to ask permission to order something. Based on the amount of purchasing power the company grants them, they can order at will and be alerted if their purchase isn't allowed or if they've reached their spending limit. The only constraint is that they must use approved vendors, but they'll have more choices than they realize.

Also, cash that previously had been lost in the shuffle of unregulated, inefficient purchasing will re-emerge on the bottom line. And the modern reengineered workplace will enjoy intelligent procurement systems that not only save money but provide significant savings in time and resources.

GOODBYE, CONVENTIONAL PURCHASING

As a financial manager, how do you feel about sifting through reams of

order requests? Wouldn't you like to see your time spent in a more valueadded manner? Even though many companies have made great strides toward managing the purchasing habits of their employees, the procurement process for nonproduction goods and services such as computer, office, and facility supplies is often unpredictable and random. A company may deal with thousands of different suppliers ranging from couriers to caterers and from IT professionals to office supply companies. Without proper checks and balances on procurement spending in place, financial managers, controllers, and CFOs can't tell where the money is going or what they are getting for it.

And companies are spending-nearly $370 billion a year on nonproduction goods and services. These maintenance, repair, and operating (MRO) items can represent as much as 30% of a company's revenues. Because MRO purchases aren't made through normal company channels, it has been difficult for accounting and purchasing departments to keep tabs on these miscellaneous but vital supplies and services needed for doing day-to-day business.

Further, the labor-intensive process of handling purchase orders can cost corporations up to $200 per transaction. And with large companies generating hundreds of thousands of purchase orders each year, processing costs can be overwhelming. Not to mention that while waiting days or weeks for approvals, employees often grow frustrated that corporate service levels don't match their need for delivery of materials.

HELLO, WEB-BASED PROCURETO-PAY SOLUTIONS

Several temporary fixes have been introduced to solve the purchasing dilemma, including client/server purchasing and requisitioning modules, electronic data interchange (EDI) systems, and standalone procurement card solutions. Although these "point" systems have brought efficiency to the purchasing process, companies still haven't realized the collective benefit an integrated solution can provide, particularly in the area of MRO purchases. Even today's enterprise resource planning (ERP) systems have ignored the handling of MRO purchases.

But Web-based technology can provide the easy answers missing from many other solutions. For one, employees make their purchases within a familiar interactive medium. Using a shopping cart-style browser, employees examine items closely with full-color pictures and descriptions and select the goods and services they need. The Web interface offers a virtual glimpse at the product being purchased-not just a product number or a line item. Maneuvering quickly through the system on the Internet, users can pick and choose, point and click, and generally make the usual tedium of business purchasing into a fun experience. An eprocurement system ties together elements of other purchasing solutions to create an integrated procure-to-pay network in which high levels of purchasing controls and high levels of service to employees can co-exist harmoniously. Best of all, the Web is a real-time interface, so with one click of a mouse or push of a button, the transaction is made-and the appropriate monies are transferred.

If you were one of the more than a million new Internet shoppers this past year, you already have a mental picture of the procedure. Through the e-procurement system, employees have direct links to supplier Web pages so they can visually confirm technical specifications and view pictures, price points, or detailed descriptions. The system creates electronic requisitions for approval, routes them through the company's approval process, and submits them electronically to contracted suppliers. When the company receives the products, the system alerts Accounts Payable to pay the suppliers. All the pieces are online-status of requisitions, approvals,

purchase receipts, and the complete history throughout the purchasing process.

E-procurement systems also streamline interactions with the supplier, resulting in faster delivery. Real-time technologies, attachment capabilities, and the ability for multiple sites or offices of the same company to share the same information enable secure, immediate order placement directly between a company and its product or service supplier. That means employees can be confident that if they place an order at 3 p.m. Monday, they will receive their supplies at 10 a.m. Tuesday.

In addition to shopping, employees can use the same system for responding to other procurement events such as making sure a new employee gets squared away. That means new employees can order supplies or business cards or they can enter data human resources needs to process.

HOW E-PROCUREMENT IMPACTS YOUR BOTTOM LINE

How can you maximize your company's return on investment with e-procurement? First, e-procurement solutions simplify the purchasing process by reducing the number of times a request is handled and by restoring policy control. They also can reduce the overall cost of nonproduction MRO supplies, reduce processing costs by 70%, lower the volume of transactions, and decrease the total number of people involved in each purchase. Result: more efficient buying practices.

E-procurement also consolidates purchasing activities among multiple sites and the supplier base so a company can maximize bulk rates and corporate discounts. The more employees buy from contracted suppliers, the more strategic relationships purchasing agents can forge with those suppliers. Ultimately, buyers can use valuable purchasing data to measure supplier performance and increase purchasing from contracted suppliers, which results in negotiating better contracts and forming more strategic alliances with them.

Another advantage: Companies improve and reduce their inventory levels when they consolidate their supply base and shorten requisition and order fulfillment cycles. In addition, most e-procurement systems bypass additional transaction fees so a buyer won't be surprised with tagged-on charges. In some cases, companies can even save on taxes, depending on the geographic chain of vendors they use to obtain a product. All these benefits help reduce the actual costs as well as the processing costs associated with purchasing MRO.

An e-procurement system also decreases the number of transactions and people involved in making each purchase as well as the actual processing time. Manual transactions usually take a week to process, including all the time spent exchanging paperwork and contacting suppliers to correct errors before anything is shipped. An e-procurement purchase takes as little as a day from the time an employee makes a request to the time the company receives the goods. In fact, using some of today's advanced systems, you can order a product in about 30 seconds.

One more advantage: E-procurement, like other procurement controls, puts an end to the accounting nightmare known as "maverick buying." This practice occurs when employees circumvent corporate purchasing policies by buying materials outside authorized channels-at retail prices-from noncontracted suppliers. For example, an employee disgruntled with the cumbersome paper trail required to buy a new shelf for the office might just walk to the store down the block rather than buying it from the company's authorized office supply source and getting reimbursed by the company. With

eprocurement, the look and feel of the screen is closest to the real shopping experience. The maverick can buy the product online, choosing the exact product he or she wants, and can count on immediate delivery. The employee is happy, results are immediate, and all the transactions are tracked through company channels.

CHOOSING THE RIGHT WEBBASED PURCHASING SYSTEM

Okay, so how do you choose the right system for your company? Critical areas you should analyze include the system's ability to handle content and manage catalogs effectively, its ease of integration with other systems in the company, and how well you think the employees will accept it.

Start with the ability to handle the key task of content and catalog management. Look at systems that can handle all sorts of suppliers who have variety of catalog options rather than forcing suppliers to have transactional Web sites. After all, the catering service on your block may not have a Webbased catalog already built, but your executives may still want to purchase food for client meetings from this supplier. The software must allow users to search for a product quickly and easily. Employees should never be required to know the name of a subcontracted service supplier or the model number for a particular product. Instead, they should be able to make a request and be guided by a series of prompts, menus, or events they can figure out quickly.

Today's top e-procurement solutions also update catalog and other information already available on supplier Web sites without requiring specific action from suppliers, other than authorization. Look for these features because they allow companies to set up a virtual cost center for real-time monitoring of purchases and of employees who ordered supplies.

Here's something else to keep in mind. E-commerce must be a cooperative effort between customers and suppliers that benefits both parties. Let's look at an example. The underlying technology links products to the supplier's Web site so the customer can "thumb through" a virtual catalog and see a full description of the products and pricing a supplier offers. Then the same technology maps data from this supplier's site and pulls the information into the customer's product index. Having joint use of the same data results in more accurate ordering and fewer returns-a huge cost savings shared by a company and its suppliers.

FOR THE TECHNOPHILES

For you technophiles, here's the way the technology should work for your company. An ideal e-procurement solution manages catalog and content management aggregation methods simultaneously. Types of content management options include OBI (Open Buying on the Internet) with links to preexisting supplier Web sites and content aggregation with a firm that is managing content for multiple suppliers for an annual fee. Other methods include local catalogs with data stored internally at an organization, proactive content that embeds artificial intelligence that will go to Web sites and pull data into the catalog, and a hybrid approach of a general index stored locally that links to online catalogs and noncatalogued items.

System integration also is a crucial component of an e-procurement system that's part of a procure-to-pay network. The ideal solution is an e-procurement system that seamlessly integrates a diverse set of resources including Webenabled applications, application data streams, and legacy data files and reports with existing operational systems. Companies often have disparate systems within the same network, particularly if they have been acquired or have merged with another company. Eprocurement solutions

that use middleware to layer procure-to-pay functionality onto existing systems require no additional hard wiring for transactional workflow.

Another key feature to look for is event-based purchasing. Event-based purchasing refers to buying activities that correlate with a company, department, or personal event. Examples range from supplies for a new employee, catering services for a trade show or an annual meeting, to services required to change an employee's office location.

If the system has event-based purchasing, a new hire can click on a computer icon for a folder marked "new employee" and access a comprehensive personal supply and service tool kit. Then the employee can use the electronic folder to set up and buy computer and office supplies, summon services such as setting up phone lines and an Internet connection, and set up voice mail and e-mail accounts. Someone who receives a promotion might need new business cards, or someone attending an upcoming trade show might require travel arrangements, registration materials, booth supplies, and other items that are used consistently for a similar event. The technology for event-based purchasing helps companies account for supplies and services needed for recurring events and can expedite and control the related purchase requirements.

MAKING THE SWITCH

By revamping the procurement process as a whole, rather than just simplifying the purchasing "event" between buyer and supplier, e-procurement enables companies to capitalize on the benefits of business-to-business e-commerce. Because it creates operational efficiencies using Internet and intranet technologies, e-procurement drives unnecessary costs out of simple transactions and frees up employees to focus on more strategic issues than completing an order.

Let's go one step further. Coupled with Web-based enterprise budgeting and planning, companies can use e-procurement to realize cost savings like never before. E-budgeting and e-procurement together can help the finance department plan directly for a system that significantly impacts the bottom line.

Enterprise-wide electronic procureto-pay solutions deliver on the promise of the Internet to provide streamlined solutions for business. It's easier and less expensive to distribute information via the Web, and employees can connect from almost any remote location. Web technology provides a new way to buy critical goods and services, so everyone becomes a strategic buyer and helps the company experience savings almost immediately. This positive bottom line impact is the driving force behind one of the biggest e-paybacks companies are discovering this year.

CALCULATE YOUR COST SAVINGS

How much money can your company save with an electronic procurement solution? To figure it out, visit MANAGEMENT ACCOUNTING'S Web site at www.mamag.com, click on the calculator icon that says "free value calculator software," and fill out the short request form. You'll receive free software from Clarus Corporation that will do the trick for you.

Sidebar:

CARD TALK

As part of their electronic procurement systems, some companies are issuing special corporate purchasing cards, or aP-cards," that work like personal

credit cards but in conjunction with e-procurement software. Employees can use them when they buy electronically, over the phone, or in person.

P-cards are a purchasing tool designed to reduce the costs associated with authorizing, tracking, purchasing, and reconciling business purchases while allowing a company's central purchasing and accounting agents to maintain control over the big picture. The cards enable you as financial managers to streamline your purchasing process, reduce paperwork, enhance information availability, speed up acquisition cycle time, reduce chances of error, and free up management personnel to focus on more strategic issues.
Many P-cards on the market today have authorization controls that allow a purchasing department to assign cards to individuals or departments and know that purchasing will be carried out according to their instructions. The purchasing department can restrict how, where, and when employees use their cards by establishing preset limits such as dollars per month and per transaction, transactions per day and per month, or even types of suppliers.

To help management accountants and purchasing agents track use of and realtime expenditures charged on P-cards, special OLAP (online analytical processing) tools and integrated technologies can create comprehensive customized reports by individual user. According to the Aberdeen Group, P-cards are more popular than other available options such as reconciling card statements, electronic funds transfer, or electronic/digital cash.

Ultimately, P-cards help a company with timely electronic reporting and quick access to critical transaction data. Used as part of the new model for enterprisewide electronic procurement, P-cards are another creative business solution to extend employees the flexibility and limited control over an allocated amount of money to buy critical goods and services when they need them.
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An XML framework for agent-based e-commerce
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ABSTRACT: CommerceNet's eCo system initiative, launched in 1996, aims to transform the World Wide Web into an agent-based infrastructure for Internet commerce. Today's Web gives people unprecedented access to online information and services. But its information is delivered in format-oriented, handcrafted hypertext markup language, making it understandable only through human eyes. Software agents and search engines have difficulty using the information because it is not semantically encoded. Tomorrow's Web will use the extensible markup language to encode information and services with meaningful structure and semantics that computers can readily understand. In Internet commerce, companies will use XML documents for publishing everything from product catalogs and airline schedules to stock reports and bank statements.
TEXT: Headnote:

Emerging standards for commercial document exchange promise open business-to-business e-commerce.

COMMERCENET'S ECO SYSTEM INITIATIVE, LAUNCHED IN

1996, aims to transform the World-Wide Web into an

agent-based infrastructure for Internet commerce.

Today's Web gives people unprecedented access to online

information and services. But its information is delivered

in format-oriented, handcrafted hypertext markup lan

guage (HTML), making it understandable only through

human eyes. Software agents and search engines have dif

ficulty using the information because it is not semantically encoded. Clever programmers work

around some of HTML's inherent limitations by using proprietary tags or software that

"scrapes" Web pages to extract content. Unfortunately, such ad hoc approaches do not scale.

Proprietary tags require browser plug-ins, and scraping approaches require a customized script

for each Web site. These approaches balkanize the Web, making it inaccessible to agents.

Tomorrow's Web will use the extensible markup language (XML) to encode information and services with meaningful structure and semantics that computers can readily understand. In Internet commerce, companies will use XML documents for publishing everything from product catalogs and airline schedules to stock reports and bank statements. They will also use XML forms to place orders, make reservations, and schedule shipments. Any agent with the proper authorization will be able to obtain computer-interpretable data sheets, price lists, and inventory reports through the Web or email, then request quotes, place orders, and track shipments.

By making the Web accessible to agents and other automated processes, XML will fundamentally transform the nature of e-commerce (see Maes et al.'s "Agents That Buy and Sell" in this issue). XML will eliminate the need for custom interfaces with every customer and supplier, allowing buyers to compare products across many vendors and catalog formats, and sellers to publish their catalog information once to reach many potential buyers. Online businesses will also be able to build on one another's published content and services to create innovative virtual companies, markets, and trading communities.

Web merchants might initially dread that XMLencoded information makes it too easy for buyers to compare prices and competitors to co-opt their content. But fear of lost business opportunity as e-commerce grows and the recognition that XML provides many other advantages for sellers (such as the ability to differentiate products in ways other than price) are likely to convince them to adopt richer markup formats. (see Wong et al.'s "Java-based Mobile Agents" in this issue). In time, most merchant Web sites will provide agent-searchable catalogs that supply product descriptions, as well as information about price and availability
For consumers, the most obvious result of pervasive markup will be smart shopping agents that level the playing field in their dealings with sellers. Using Internet-wide shopping directories, these agents will be able to locate all merchants carrying a specific product or service, then query them in parallel to locate the best deals. Some merchants will provide sales agents that negotiate with shopping agents and generate customized offers in response to their solicitations. The shopping agents can then sort the offers they receive according to criteria set by their owners-the cheapest flight, the most convenient departure time, the roomiest aircraft, or some weighted combination. Cybermediaries will offer innovative brokering and referral services that match buying and selling agents, as well as orderaggregation services that increase their purchasing clout.

Agent-based shopping by consumers is just the tip of the e-commerce iceberg. Whenever a product is bought, information propagates back down the supply chain, triggering a series of distribution, manufacturing, and logistics events. Today much of this business-to-business information is exchanged through EDI messages. But traditional EDI is complex and expensive, because most messages travel over proprietary networks. Moreover, EDI's brittle syntax necessitates a custom integration solution between each pair of trading partners.
For these reasons, EDI transactions will increasingly take place over the Internet using an XML/EDI message format. Such messages will be more economical than traditional EDI messages, while being easier to validate and translate into the formats needed by applications at each end of the exchange [4]. This development will encourage businesses, including many that find traditional EDI too costly, to implement Web agents that respond to XML messages. This agent-based approach to enterprise integration is simpler and more open than traditional EDI, because it avoids the "pairwise

tyranny" through which big companies impose proprietary message formats on small companies. Moreover, publishing XML-encoded documents, such as data sheets and price lists, on the Web makes the information available instantly to all potential trading partners. Instant availability transforms rigid supply chains into "supply Webs," in which participants transact business spontaneously (see Figure 1).

(Illustration Omitted)

Captioned as: Figure 1

Figure 2.

The eCo System began as an architectural vision for open Internet commerce [5], proposed and evangelized by the 500-member worldwide CommerceNet Consortium in 1996. Conceived originally as a CORBA-based interoperability framework, the eCo System architecture was recast in 1997 on an XML foundation, due to XML's simplicity and widespread adoption by key vendors, including IBM, Microsoft, Netscape, and Sun.

Today's eCo System enables companies to communicate over the Internet using self-defining XML business documents that agents, as well as people, can easily understand. Business Interface Definitions (BIDs), posted on the Web, tell potential trading partners what online services a company offers and what documents to use when invoking those services. For example, a BID might allow a customer to order goods by submitting a purchase order or a supplier to check availability by downloading an inventory status report (see Figure 2).

A key element of the eCo System framework is the Common Business Library (CBL), an extensible, public collection of generic BIDs and document templates that companies can customize and assemble to go online quickly.1 CBL includes XML message templates for the basic business forms used in ANSI X12 EDI transactions, as well as those used in such emerging Internet specifications as Open Trading Protocol (OTP) and Open Buying on the Internet (OBI). These specifications are mapped to each other using a dictionary of common business terms and data elements. A company can thus define its business interface in terms of any Internet standard mapped to CBL and communicate instantly with every other company that has done the same, even when the companies subscribe to different standards.

The eCo System framework overcomes two longstanding barriers to e-commerce. CBL facilitates spontaneous commerce between trading partners without custom integration or prior agreement on specific industrywide standards. And by being interpretable by both people and agents, XML documents provide an incremental path to business automation, whereby browser-based tasks are gradually transferred to computer agents. These advances eliminate much of the time, costs, and risks of traditional system integration. Moreover, the eCo System transforms closed trading partner networks into open markets and extends such enterprise applications as inventory management and production scheduling across entire supply chains.

XML is a simplified metalanguage, derived from SGML, emerging as the standard for self-describing data exchange in Internet applications. XML was developed by the World-Wide Web Consortium in 1997 and is being implemented rapidly by such major platform vendors as IBM, Microsoft, Netscape, and Sun Microsystems. XML's power derives from its extensibility and ubiquity. Anyone can invent new tags for particular subject areas, defining what they mean in document type definitions (DTDs). Content-oriented tagging enables a computer to understand the meaning of

data, including, say, whether a number represents a price, a date, or a quantity

This tagging significantly increases the functionality of Web e-commerce applications, because they can now do much more than simply display product data. For example, items in an XML-encoded catalog can be sorted by price, availability, and size.

One of eCo System's longstanding goals has been to enable businesses to build on one another's services to create virtual enterprises. Such plug-andplay commerce involves modeling enterprises as collections of services, some internal to a particular business, others provided by trading partners. Business services in eCo were originally defined as CORBA application programming interfaces (APIs). While the CORBA approach appears workable within organizations that control APIs, our experience in several prototypes suggests it is not practical for interenterprise integration. Fortunately, XML offers a promising alternative-agents interacting with business services through business documents.

Business documents represent a more intuitive and flexible way to access business services than programming APIs. It is much easier to interconnect companies in terms of the documents they exchange, on which they already largely agree, than in terms of their business system interfaces, which invariably differ. The coupling is looser, but loose coupling is better than no coupling at all.

XML's human readability is another significant advantage over CORBA. Just as HTML is a language for the eyes, CORBA is a language for CPUs, meant to convey information among programs, with no concession to human readability. XML documents are as readily interpretable by humans as they are by computers, especially with the aid of a style sheet [2].

Other proposals for agent languages suggest that first-order logic or other formal languages enable more precise specification of messages than XML [1, 3]. We prefer XML for two reasons-one languagetheoretic, one practical. Expressing semantics in syntax rather than in first-order logic leads to a simpler evaluation function while needing no agreement on the associated ontologies. The practical argument, which is much more important for commercial success, is XMLs ubiquity. The Web has made everyone appreciate the power of markup languages, practically assuring the widespread adoption of XML, as HTML's heir apparent. XML may be theoretically less expressive than other formal languages, but we prefer a language that can be understood and produced by computer novices to a theoretically better one spoken only by computer scientists.

The significance of XML for integration extends beyond the Web to email, database records, and programming APIs. An XML parser imposes the same API on any XML data source, eliminating much of the need for custom programs to extract and integrate information from each source. So, integrating enterprise information from accounting, purchasing, manufacturing, shipping, and other functions can be accomplished by first converting each source to XML and then processing the parsed data stream. Put another way, each application need know only two source formats-its own and XML-rather than having to produce the native format of every other application.

XML by itself doesn't enable plug-and-play commerce. In addition to the language itself, a complete business integration solution also requires: standardized tags, or metadata, for each commerce community; a means for mapping between different metadata descriptions; and a server for processing XML documents and invoking appropriate applications and

services. The eCo System framework starts with XML and adds these additional architectural and technology elements.

Specialized Markup Languages

XML makes it easy to create specialized markup languages that identify and describe buyers and sellers, the goods and services they want to buy or sell, and the various other document types involved in commerce. However, a vendor has obvious incentives for describing its offerings in ways that highlight its competitive advantages and that obscure comparison on features where it lacks an advantage. But if every business invented its own XML definitions for product catalogs, requests for quotes, price lists, purchase orders, invoices, transportation schedules, shipping notices, and delivery and payment receipts, the Web would be scarcely more usable as a platform for agents and other automated processes than it is today (see Smith's and Poulter's "The Role of Shared Ontology in XML-based Trading Architectures" in this issue).

Fortunately, many companies already recognize the need for information-exchange standards, uniting in several initiatives focusing on XML standards for particular industries or business processes (see the sidebar "Domain-specific E-commerce Languages"). Unfortunately, these initiatives operate independently, doing little to facilitate interaction across industry and functional boundaries. The solution is to spur development of XML document models based on reusable semantic components common to many business domains. Such documents can be understood by any business through their common elements (such as address, date, and part number), while also providing a common mechanism for linking to the unique elements vendors need to differentiate themselves.

The CBL is designed to encourage development and use of generic XML document models. The library consists of information models for various concepts, including:

Business descriptions, such as companies, services, and products;

(Chart Omitted)

Captioned as: Figure 3.

Business forms, such as catalogs, purchase orders, and invoices; and

Standard measurements, such as date and time, location, and classification codes.

These models are represented as an extensible, public set of XML building blocks that companies can customize and assemble to develop XML applications quickly. Atomic CBL elements implement industry messaging standards and conventions, such as standard International Organization for Standardization (ISO) codes for countries, currencies, addresses, and time. Low-level CBL semantics are also derived through analysis of proposed metadata frameworks for Internet resources, such as the Dublin Core metadata element set developed by the Online Computer Library Center.

The next level of CBL elements use these building blocks to implement the basic business forms used in X12 EDI transactions, as well as those in OTP, OBI, and other emerging Internet standards.

A working group organized by CommerceNet and other organizations recently began using CBL to create a base set of common terms, or mappings, between existing terms in commerce specifications, including OBI and OTP The final

result scheduled for release in mid-1999 will include a recommended base set of XML data elements, attributes, and definitions for use in e-commerce standards initiatives; they will be made freely available in public registries run by CommerceNet and other organizations. The Internet community, building on this foundation, will be encouraged to contribute additional elements and document models.

(Table Omitted)

Captioned as: Figure 4.
Figure 3 shows how Federal Express might use CBL to create an XML version of its airbill by customizing a generic purchase order DTD with specific information about shipping weight. The generic purchase order, in turn, is assembled from more primitive CBL modules for address, date and time, currency, and vendor and product description. This example shows how reusing CBL components can significantly speed development of XML e-commerce applications and facilitate their interoperation.

When creating CBL, we found it helpful to extend XML with a schema language. The extensions add strong typing to XML elements so content can be readily validated. For example, an element called CPU_clock-speed can be defined as an integer with a set of valid values: 100, 133, 166, 200, 233, 266 Mhz. The schema language also adds class-subclass hierarchies, so information is readily instantiated from class definitions. A laptop, for instance, can be described as a computer with additional tags for such features as display type and battery life. These and other extensions facilitate data entry, as well as automated translations between XML and traditional object-oriented and relational data models.

Trading partners not only have to agree on the meaning of message tags but understand how to use them for conducting business. In the eCo System, BIDs tell potential trading partners what online business services a company offers and which documents to use when invoking those services. In effect, services are defined by the documents they accept and produce. BIDs present a clean and stable interface to business partners, insulating them from a company's internal changes in technology, organization, and processes.

Figure 4 shows a fragment of a BID, defining an XML service for an eCo-compliant business. The service definition consists of two transactions-one for taking orders, one for tracking them. Each definition expresses a contract, or promise, to carry out a service if a valid request is submitted to the specified Web address. The order service requires an input document conforming to a standard po . dtd DTD in an industry registry operated by CommerceNet. If the service is able to fulfill the order, it returns a document conforming to a customized invoice . dtd whose definition is local. In effect, the company is promising to do business with anyone submitting a purchase order conforming to the XML specification it declares. No prior arrangement is needed.

A DTD is the formal specification, or grammar, for documents of a given type, describing the elements, their attributes, and the order in which they have to appear. For example, purchase orders typically include the names and addresses of the buyer and seller, a set of product descriptions, and associated terms and conditions, such as price and delivery dates. In the EDI world, the X12 850 specification is a commonly used model for purchase orders.

From Business Services to Virtual Enterprises

eCo servers provide the glue that links a set of internal and external

business services to create a virtual enterprise or trading community. The server parses incoming documents and invokes the appropriate services (as specified by the applicable BID) by, say, handing off a request for product data to a catalog server or forwarding a purchase order to an enterprise resource planning system. The eCo server also handles translation tasks, mapping the information from one company's XML documents onto document formats used by its trading partners and into data formats required by its own legacy systems.

Following the service definition in Figure 4, when a company submits a purchase order, the XML parser in the eCo server uses the purchase order DTD po . dtd to transform the purchase order instance into a stream of information events. These events are then routed to any applications programmed to handle events of that type; in some cases, the information is forwarded over the Internet to an entirely different business. In the purchase order example, information coming from the parser may be acted on by various applications:

An order entry system processing the purchase order as a complete message;

An enterprise resource planning system checking inventory for the products described in the purchase order;

A customer database verifying or updating a customer's address;

A shipping company system using the address information to schedule a delivery; and

A bank system using credit card information to authorize a transaction.

However, what is most important in such processing is what is left out. Trading partners need agree only on the structure, content, and sequencing of the business documents they exchange, not on API details. How a document is processed and what actions result are strictly up to the business providing the service. This focus on commerce elevates enterprise integration from the system level to the business level.

A True Marketplace

eCo Systems top-level goal is to transform the Web into a true marketplace by enabling spontaneous, peer-to-peer exchange of electronic business documents among all companies. This document-based approach replaces complex, expensive, and proprietary business integration solutions with one that is simple, affordable, and open.

The eCo architecture recognizes that a single dominant e-commerce standard is unlikely, even within a particular business community (and certainly not across communities). Rather, there will be many standards. CBL, in particular, is not a single standard but a collection of common business elements underlying all EDI and Internet commerce protocols. Its reusable components speed implementation of standards and facilitate interoperation by providing a common semantic framework. This approach to standards implementation and interoperation is fundamentally different from that taken historically by standards organizations and software vendors. It occupies an openness high ground embracing all the new competing standards being developed to take advantage of XML.

The eCo system framework and CBL are being evaluated in several of the standards initiatives listed in the sidebar on domain-specific commerce languages, as well as two major market trials sanctioned by CommerceNet:

The U.S. General Services Agency (GSA). The largest buying organization in the U.S., GSA is creating catalog interoperability across numerous government agencies. Until now, the catalogs belonging to participating agencies were implemented as relational databases, as static files, or as catalog applications. An eCo server transforms each of these information sources into a standard catalog service that responds to CBL queries by outputting an XML data stream conforming to a common catalog schema. The integrated source catalogs can then be searched through specialized user interfaces developed by various participating technology vendors.

RosettaNet. The RosettaNet consortium of PC manufacturers, resellers, and distributors is developing integration standards for the PC distribution channel; participants include Compaq Computer, CompUSA, Dell Computer, HewlettPackard, IBM, Ingram Micro, Merisel, Microsoft, and Tech Data.

The XML document models used in these initiatives are being rationalized to identify common semantic elements. These elements will be added to various public CBL repositories and made freely available (for more detail, visit www.commerce.net and www.veosystems.com).
Sidebar:

Do,main-specific Commerce Languages

The power of XML in enabling interoperability and simplifying the sharing and reuse of information between business domains is encouraging companies to work together to develop XML-based specifications for the business information they exchange most often. Sample specifications include:

Open Trading Protocol. A consortium of banking, payment, and technology companies is specifying information requirements for payment, receipts, delivery, and customer support (www.otp.org). The goal of OTP is efficient exchange of information when the merchant, the payment handler, the deliverer of goods or services, and the provider of customer support are different entities with their own systems.

XML/EDi. A group chartered jointly by CommerceNet, ANSI X12, and the Graphics Communication Association is defining how traditional X12 EDI business data elements should be represented using XML (www.xmledi.com).

RosettaNet. This PC industry initiative is defining how to exchange PC product catalogs and transactions among manufacturers, distributors, and resellers (www. rosettanet. org).

Open Buying on the internet. The OBi initiative, launched by American Express and major buying and selling organizations, including Ford Motor and Office Depot, is automating large-scale corporate procurement of office and maintenance supplies (www. openbuy. org)

Information and Content Exchange. CNET, News Corp., Vignette, and other information content providers are developing ways through ICE to create and manage networked relationships, such as syndicated publishing networks, Web superstores, and online reseller channels (www.w3.org/TR/1998/NOTE-ice-1998 1026).

Open Financial Exchange. Originally proposed by CheckFree, Intuit, and Microsoft for the electronic exchange of financial statements among consumers, small businesses, and financial institutions, the OFX effort supports banking, bill payment, investment, and financial planning activities (www.ofx.net).

Sidebar:

Agent-based shopping by consumers online is just the tip of the e-commerce iceberg.

Footnote:

1The CBL was called the Common Business Language in earlier descriptions of eCo System. The change emphasizes CBL's function as a set of building blocks for XML applications and its role as a complement (rather than as a competitor) to ICE, OBI, OFX, OTP, RosettaNet, and other commerce languages.

Footnote:

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